



[Back](#)

01/05/2003 (10:51)

Notes from a Symposium "PE 100+ : Don't crack under pressure" Part 1

On April 3, representatives both from domestic and foreign companies participated as speakers at the PE 100+: Total Quality Water and Gas Pipe Systems Symposium organized by the PE 100+ Association in Ankara and gave some information about these systems. Brief notes and some important points will be presented to you in this series of bulletins from the symposium that ChemOrbis also attended.

First, Borealis A/S Marketing Manager Robin Bresser made a presentation and gave information about the PE 100+ Association and its goals.

The PE 100+ Association was founded under the leadership of Borealis, Elenac and Solvay in 1999. Now, Atofina, Basell, Borealis, BP Solvay PE and Sabic have managing roles in the association. Specialists from natural gas and water companies also contribute to the association through studies.

The goals of the association can be summarized as:

- Creating a brand of quality for PE100+ products
- Ensuring continuous high quality in the production and application of PE 100 as a raw material for pipes
- Encouraging expansion of application areas for PE
- Focusing on the end consumer by providing more informative support
- Accepting PE producers that comply with the high standards of the PE100+ Association

In short, the PE100+ Association aims at ensuring the proper raw material, the right application and high quality products are used for PE pipe systems. For more detailed information about the PE 100+ Association please visit www.pe100plus.net.

At the PE 100+: Total Safety Water and Gas Pipe Systems Symposium, Turkish processor Superlit's Technical R&D and Marketing Manager, Teoman Colakoglu, made a presentation about the benefits of PE 100 raw materials. The presentation summarized the basic benefits of PE 100 as follows:

- Elasticity - the pipe can be given a curved shape without a straddle bent
- Excellent welding - lower cost and leak-proof
- Preserving the natural state of water - proper for drinking water, no sediments and corrosion in the pipes
- Long life
- Existing pipe lines can be renewed with PE 100
- Resistant to chemicals

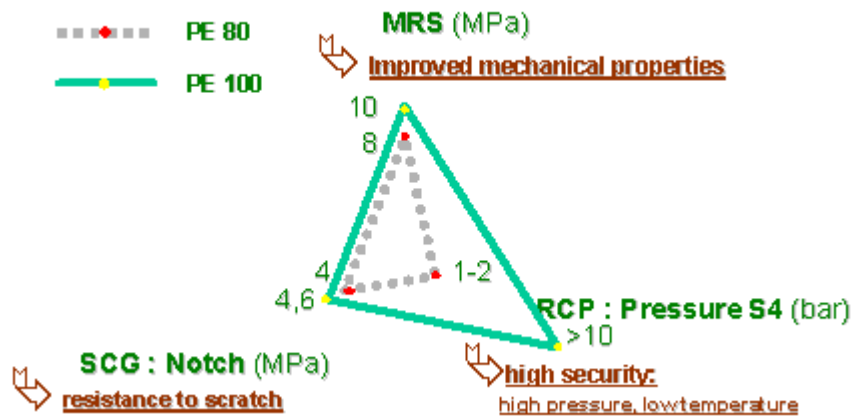
From Firat Plastik, Quality Manager Mehmet Erdogan made a presentation about the technical properties of PE 100 which entered the market in the 1990s, and is described as the 3rd generation PE. For testing the quality of PE 100 pipes, first of all, hydrostatic pressure tests are needed. With these tests, rapid crack propagation (RCP) and slow crack growth (SCG) values are provided.

In the presentation it was reported that, compared to PE 80 with a minimum required strength (MRS) of 8 MPa, PE has 10 MPa MRS. The important mechanical properties were also detailed. Regarding RCP and SCG, the following explanations were made respectively:

A strike to the pipe caused by high pressure and/or low temperature can result in a crack extending hundreds of meters very quickly.

SCG is the long term aging that causes brittle breaking which can be hastened if there are scratches and when the pipe is in contact with stone.

According to the measurements made, PE 100 has a 50 year life span, thus, it is ideal for applications with large diameters.



Dizayn Teknik Quality Manager Hakan Belen said that after the 1999 Izmit earthquake they started research in Adapazari. He indicated that while they have found problems in all the lines where rigid pipes were used, there was no damage whatsoever, in the lines where PE 100 pipes were used.

Belen emphasized that the important point was not only related to the pipes, but also the joint packings and connections, thus with the other fittings, adding PE 100 systems should be examined as a whole.

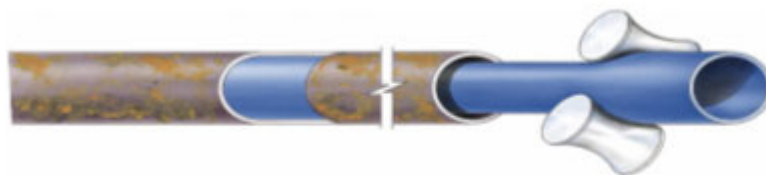
Belen said that in the earthquake zones, natural gas pipe lines are critically more important compared to the water pipe systems, explaining that there are various types of pipes ranging from diameters of 1000,1200 to1400 mm with which they had no problem in the 12,000 meters of PE 100 installation in the Izmir Aliaga Thermal Power Plant.

The English contractor company Subterra's manager Dr. Mark Hoffman, too, provided information about the modernization project his company is conducting for water and natural gas lines. He said 80% of the water pipes in England are made out of PE, focusing on the modernization methods for old pipes.

He pointed out the significant points about the methods in pipe line modernization saying that these methods:

- Prevent leakage
- Enhance structural integrity
- Preserve the water quality
- Create less problems for the customer and the society
- Can be applied faster and with lower cost compared to building a brand new system

Among these modernization methods, Hoffman particularly focused on the rolldown method and Subline method which is an inside liner PE system.

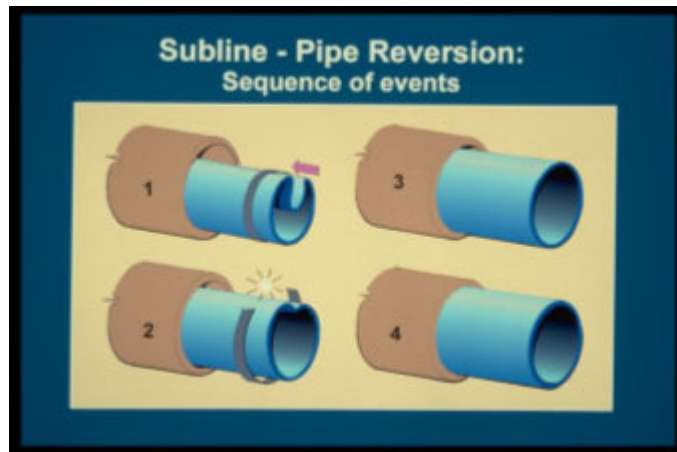


rolldown method

Some details about the rolldown method are as follows:

- Typical diameter drop value is 10 %
- Inside liner PE can be prepared away from the construction site and later transported to the site

- Installation process consists of simply a "roll-down" operation
- Rolled-down pipe can be joined through fusion splice before transforming to a "close-fit"
- Application diameters range between 100 - 500 mm
- Standard Diameter Ratio (SDR) = 11 - 26
- Flexibility up to 11.25°
- 1,500 m length with a 250 mm diameter in one single application
- Longer than 500 km application area



Subline method

The Subline method is an assembly operation by unfolding a PE liner that comes to the site folded. In this operation, the PE liner with a thin wall is used. Some data about this method was provided:

- Liner memory is round and it tends to be round again
- No heat is used. There isn't any excessive stress resulting from tension
- It can be applied to every kind of host pipe material
- 75 - 1600 mm diameters
- SDR = 26 - 80 (depending on the diameter)
- 700 m length in one pull
- Flexibility up to 22.5°
- Record high project: SDR 61, 1200 mm diameter, 2.8 km. - the largest in the world

You will be able to read important information from the other presentations and the discussions that took place in the question-answer session in the symposium in the next bulletin, "PE100+ Don't crack under pressure - Part 2".



[Back](#)

13/05/2003 (10:00)

"PE 100+ : Don't crack under pressure" Part 2

At the PE 100+: Total Quality Water and Gas Pipe Systems Symposium organized by the PE 100+ Association and held in Ankara on April 3, 2003, Egeplast Production Manager Gunay Biltekin gave information about the replacement process of 100 year old water pipes in Germany. Biltekin said that water pipes in Dresden were mostly made of cast iron and steel, noting that as the traffic increased and the quality of drinking water in the city got worse, a PE 100 relining method was applied to these pipes.

He said that local officials and some associations had concerns about the process, since the application was made in a very narrow street surrounded with historical buildings, but the result was a success without any damage to the porcelains and paintings on the walls of the buildings.

The possibility of corrosion was prevented by scraping the inner surface of the cast pipes with mechanical scrapers, and then in-liner pipes were installed inside the old pipes after which, they were welded by heat.

Biltekin also made a comparison between the costs of installing new cast iron pipes and using PE 100 to renew the existing pipes. He said that the cost of repairing the existing pipes is 40% cheaper than installing new pipes.



The impact of the load exposure to the pipe

Dr. Jan Willem Luiten from Gastec Certification BV, Holland gave information about the quality control methods for PE 100 raw materials and pipes. He said that the most important factors for the quality of a pipe is its resistance to environmental conditions and its handling of load, indicating that the quality of PE 100 is dependent on the following:

- PE resin
- Additives
- Pigments
- Production, that is, the polymerization method

Luiten emphasized that the following tests are very important for PE 100 pipes:

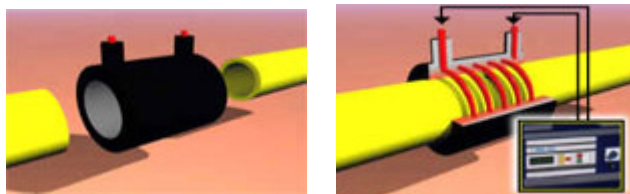
- Hydrostatic Pressure Test
Understanding the effects of the additives in the raw material, environmental effects, heat and pressure factors
- Notch Test
The effects of the molecular structure of the raw material, pigments and notches
- Rapid Crack Propagation
Thickness, heat and pressure factors

Luiten added that quality is very important for a pipe producer, saying that the

product and its quality should be appropriate for its usage as well as being compatible with the European Union regulations.

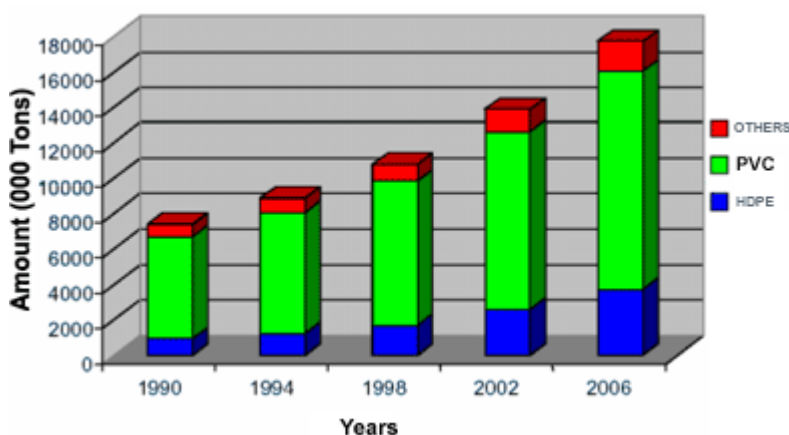
In the symposium, Murat Cavusoglu, the chairman of an Ankara based company named Tega, also made a presentation about pipe junctions and welding technologies. Cavusoglu focused on the fundamentals of the electro-fusion welding technique in particular, emphasizing that pressure, heat and time parameters are especially important and much more efficient applications can be made with the proper raw material and welding technique.

Electro-fusion process



Lastly, Kocaeli University Mechanical Engineering Professor Dr. Pasa Yayla noted that in recent years, PE pipes which are more flexible and easier to shape have begun to replace PVC in the pipe industry.

Indicating that non-corrosive and lime-resistant PE pipes are 70 % cheaper than steel pipes, Yayla said that according to DIE (National Statistics Institute) data in 2000, per capita pipe consumption in Turkey was 2.5 kg and that figure is expected to rise.



Global plastic pipe market and its trend

Prof. Yayla concluded his speech indicating that:

- Long term performance is very important in pipe systems. They are designed for a usage period of at least 50 years.
- Raw material properties should comply with the determined standards and they must be subject to controls.
- The usage of plastic pipes is increasing day by day, particularly for natural gas and water pipe applications. Plastics consumption will increase both in Turkey and in the world with the improvement in technology.
- Plastic pipe producers must produce high quality products using the right raw materials.
- Plastic pipe consumers must be sure of the quality of the product they purchase and use them in the right way.

Question-Answer Session

The attendees of the seminar participated in a question and answer session where they discussed the pro and cons of various types of PE 100 materials. They discussed the differences between natural and colored grades and some of the issues that arise when deciding which materials to use. They also discussed the effects on competition between the various materials and standards, and concluded that it was up to the end consumers to be very specific about what they required.

- Egeplast General Manager Sami Yuksel asked what the plans of the PE100+ Association are regarding the unfair competition between the producers who are members of the association and those who are not. The association representatives said that the products of member companies are tested once every seven months, raw material tests are made on a regular basis, and that faulty products can never be included among the recommended products by the association. Robin Bresser from Borealis A/S noted they are aware of the fact that the prices of the products recommended by the association are high, but this is because both the quality and the process-ability of these raw materials are very good, adding that high costs must be tolerated for better and higher quality products.
- Petkim Quality Control Technical Service Manager, Dr. Rahim Isler, asked if colored raw material should be used where there is no sunlight. The association representatives said that a pipe would be exposed to sunlight sooner or later, giving the values for PE raw material's resistance to light included in the Turkey TS 418 and prEN 12201 Europe standards.
- A company representative from IZSU asked how healthy are the PE 100 pipes. Dr. Rahim Isler from Petkim answered this question, saying that the criteria for this are based on the Turkish Food Codex in which all related criteria, and the amount of the chemicals allowed for the raw material used are specified clearly. He emphasized that the Turkish Food Codex has been revised according to the European Union standards and early this year the announcement of this revision was released by the Ministry of Food, Agriculture and Livestock in the Turkish Official Newspaper as a regulation under the title of "Plastics in contact with food". Also, Robin Bresser noted that there are similar standards in Europe, and it has been proven that due to the fact that it is natural, odorless, and tasteless, PE 100 does not create any health problem for drinking water.
- Some of the representatives from public companies asked how long it takes this material to degrade. Hakan Belen from Dizayn Teknik replied that sooner or later, oxidation is inevitable for any kind of plastic because every material that is produced must wait in a warehouse or in another place for some time, and will be exposed to light. Kocaeli University Prof. Dr. Pasa Yayla added that some additives are added to the material during the production to prevent degradation at high temperatures. Bresser said that there is no need to worry about this since PE 100 includes many stabilizers, and in fact it is an important point not to add too many stabilizers during the processing, and produce a product that is not homogenous. He emphasized that when the distribution is not homogenous, breaking and cracking would occur in the weak points, and these would spread very quickly.
- Esen Plastik Plant Manager Hakki Turker asked why colored PE 100 raw materials were heavily promoted after Petkim started natural color production. Petkim stated that: "PE 100 production is all about economy. Petkim, or another company, has to prepare a contract according to the purpose of the production. There are lots of grades of carbon black which are used for black pipes. This has to have standards, too. The most important point is performing the extrusion properly. You can mix a natural raw material with the carbon black in an extruder that can ensure a very good distribution. But, if the processing is bad, the pipe that is produced would not have the quality that is targeted. Plus, there is no need for a pipe that will be used under the ground to have color. Because carbon black only makes the pipe recognizable and helps decrease the impact of sunlight on the plastic."

Regarding this issue, BP Solvay PE representative Alpan Fulat stated the following to ChemOrbis: "Since the 1990's, PE 100 material is produced as a colored product by the association members because materials which are colored afterwards cannot distribute the carbon black with standard rates of pigment distribution that are specified. As specified in the prEN12201 standard updated in 2001, the materials that will be used in pipes are required to be self colored and with added additive compounds. Again in the same standard, it is emphasized that only a compound (color and additives added) material can be categorized by the PE raw material producer. We agree that it is very important to prepare specification contracts according to the purpose of the usage for the pipes, but we think that it is equally important to meet the requirements of these contracts exactly as specified as well. We think that there are a lack of independent control mechanisms for this in Turkey. We don't even want to imagine how much harm can be given to the country both financially and

morally as a result of an explosion or damage because of a misuse of raw material"

- " Egeplast General Manager Sami Yuksel pointed out the commercial dimension of the subject and said that in the public tender contracts in particular, the required raw material is specified as original black or blue, but since the required properties are not given clearly, some companies offer pipes with prices that are equivalent to the raw material price. He said that they offer natural material that is colored during production as opposed to originally colored material. Yuksel emphasized that people who are opening a tender must be very careful about this, and warn the company making an offer when they are confronted with such a situation. Hakan Belen from Dizayn Teknik also supported Yuksel's remarks, adding that end users must open their tender after specifying their requirements. Belen indicated that in such a purchase the requirements can be controlled by a third party because quality is very important in building infrastructures, thus, independent audit firms must be founded to bring an objective approach to the tenders in the way that can be seen in other countries.

To learn more about PE 100 see the ChemOrbis bulletin dated June 28, 2001, [PE 100 pressures its way in.](#)

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